

JAPAN

EDICT OF GOVERNMENT

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JIS Z 9122 (1997) (English): Lighting for sports halls

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*The citizens of a nation must
honor the laws of the land.*

Fukuzawa Yukichi

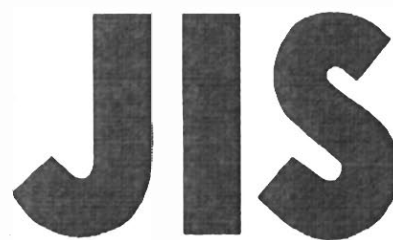
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STANDARD

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JIS Z 9122 : 1997

Lighting for sports halls

ICS 91.160.10; 97.220.30

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specifications, roof spaces, lighting levels

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Lighting for sports halls

1 Scope This Japanese Industrial Standard specifies lighting for sports halls for general indoor sports. The general indoor sports mean the gymnastics, rhythmic sportive gymnastics, tennis, table tennis, badminton, basketball, volleyball, handball, judo, kendo and wrestling.

Remarks : The following standards are cited in this Standard:

JIS C 1609 *Illuminance meters*

JIS C 7612 *Illuminance measurements for lighting installations*

JIS Z 8113 *Glossary of lighting terms*

2 Definitions For the purpose of this Standard, the definitions given in **JIS Z 8113** and the following definition apply:

$\frac{1}{2}$ illuminance angle When a horizontal plane is illuminated by the light distribution with vertical reference axis, this means the angle made by the downward reference axis and a straight line connecting the point on the plane where the horizontal illuminance is $\frac{1}{2}$ of that at a point directly under the light center.

3 Requirements for execution of lighting

3.1 Investigation items At making a plan for lighting for sports halls, preliminarily investigate the following items:

- (1) **Structure of facilities** The following matters shall be taken into account:
 - (a) Shape and dimensions of facilities, number of field surfaces, condition of windows, whether stands are installed or not, etc.
 - (b) Material, color, reflectance, etc. of ceiling, wall and field surface.
 - (c) If stands are installed, their material, color, reflectance, etc.
 - (d) Places where luminaires are able to be equipped, or the like.
- (2) **Details in utilization** Distinction to be athletic sports or recreation and distinction of cases where sports are televised or where not done so.
- (3) **Power supply condition** Electrical system, service voltage, frequency, power capacity, etc.

3.2 Design of lighting At carrying out of design for lighting of sports halls, take into consideration the following matters:

- (1) **Illuminance and its uniformity ratio** Give sufficient lighting to the whole field surface and ensure good uniformity ratio.
- (2) **Glare** Take into consideration the reducing of direct glare from the luminaires as far as possible so as not to cause remarkable interference to athletic sports.
- (3) **Stroboscopic phenomenon** In the case of burning discharge lamp by commercial frequency (50 Hz or 60 Hz), reduce the stroboscopic phenomenon as far as possible.
- (4) **Light source** Select the suitable light source with taking into consideration the following matters:
 - (a) Luminous efficacy of the lamp (in the case of discharge lamp the overall efficacy including the ballast loss)
 - (b) Life and luminous flux maintenance factor
 - (c) Light source color and color rendering properties
- (5) **Others** Take into consideration the following matters:
 - (a) Easiness of maintenance and control
 - (b) Economical property
 - (c) Fine view
 - (d) Safety lighting
 - (e) Spare circuits

4 Standard of lighting

4.1 Lighting range The lighting range is to be the whole floor surface of sports hall.

4.2 Illuminance and its uniformity ratio The average illuminance (horizontal illuminance) and its uniformity ratio of field surface are to be the values shown in Table 1.

Measuring method of illuminance is given in the Annex.

Table 1 Average value and uniformity ratio of horizontal illuminance

Classification	Horizontal illuminance	
	Average value lx	Uniformity ratio ⁽¹⁾
Official sport ⁽²⁾	1 000 min.	0.50 min.
Unofficial sport ⁽³⁾	500 min.	
Recreation ⁽⁴⁾	250 min.	0.40 min.

Notes ⁽¹⁾ Uniformity ratio of horizontal illuminance shall be calculated by the formula (1).

$$Uh = \frac{Eh_{\min}}{Eh_{\text{ave}}} \dots\dots\dots (1)$$

where, Uh : uniformity ratio of horizontal illuminance
 Eh_{\min} : minimum value of horizontal illuminance (lx)
 Eh_{ave} : average value of horizontal illuminance (lx)

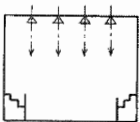
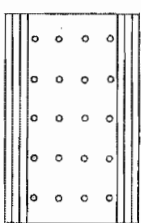


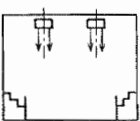
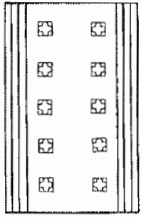


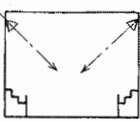
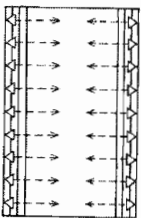


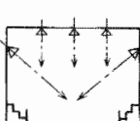
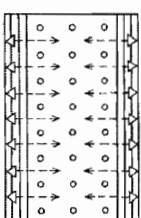


- (2) Sports the results of which are remained as officially recognized record
- (3) Sports other than official sports
- (4) Sports for enjoying leisure or for improving health

Remarks : Illuminance and its uniformity ratio for television photographing shall be as given in 5.

4.3 Lighting system The lighting system is to be, as a rule, direct lighting system.

4.4 Arrangement of luminaires The arrangement of luminaires is to be selected from Table 2.

Table 2 Arrangement of luminaires

Arrangement of luminaires	Example of arrangement of luminaires	Sports halls of small type and medium type		Sports hall of large type	Sports hall on the premise of television photographing
		Sectional view	Plan		
Dispersed arrangement	Reflectors for luminaires or floodlights are dispersed-arranged on the whole ceiling with each one unit.				
	Reflectors for luminaires or floodlights are dispersed-arranged on the whole ceiling with integrating plural units as the large type apparatus.				
Side arrangement	Luminaires are arranged in row on both sides of a sports hall.				
Together use of dispersed arrangement and side arrangement	Either one of dispersed arrangement and side arrangement are combined.				

Remarks 1 ○: It is suitable. ○: It may be used.

2 Classification of sizes of sports halls are as follows:

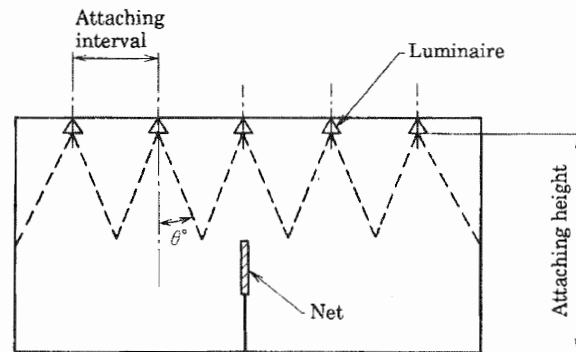
- (1) Small type: The sports hall of such degree that only one face of basketball court can be taken.
- (2) Medium type: The sports hall of comparatively large sports hall of such degree that three basketball courts can be taken.
- (3) Large type: The large sports hall capable of taking four or more basketball courts.

3 In the case where the television photographing is premised, independent of classification by size, the column of sports hall on the premise of television photographing of Table 2 applies.

4.5 Attaching interval and attaching height of luminaires

- (1) The attaching interval of luminaires in dispersed arrangement is to be in the range of $\frac{1}{2}$ illuminance angle on the field surface.

Further, in the sports hall to carry out athletic sports such as volleyball and the like using high sports space as shown in Fig. 1, these are arranged so as the height of net upper end to satisfy $\frac{1}{2}$ illuminance angle.



Remarks : θ indicates $\frac{1}{2}$ illuminance angle.

Fig. 1 Attaching interval of luminaires in dispersed arrangement

- (2) The attaching heights of luminaires in side arrangement are to be the positions of 30° or more in upward including angle from the floor surface at end of sports hall, as shown in Fig. 2.

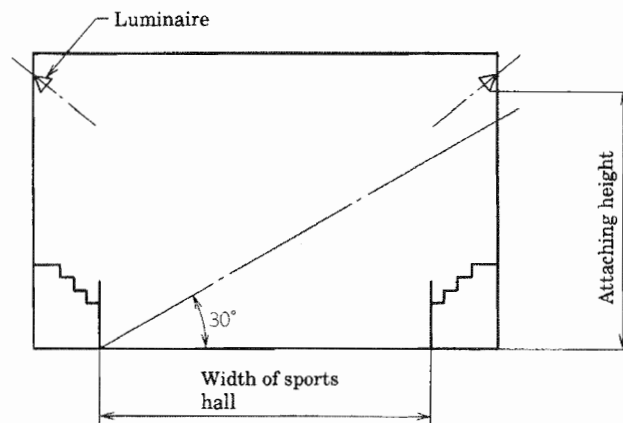


Fig. 2 Attaching height of luminaires in side arrangement

4.6 Luminaires In the sports hall, mainly a reflector for luminaires or a flood-light is used independently, or as a large integrated type apparatus of plural units.

Further, a suitable protective net or the like should preferably be attached so as the rupture of luminaires not to be generated due to impact of sports devices such as balls.

5 Standard of lighting for television photographing

5.1 Illuminance and its uniformity ratio Illuminance and its uniformity ratio shall have the values shown in Table 3.

Measuring method of illuminance is given in the Annex.

Table 3 Average value and uniformity ratio of illuminance

Division of illuminance	Average value lx	Uniformity ratio ⁽⁵⁾
Vertical illuminance ⁽⁶⁾	1 000 min.	0.30 min.
Horizontal illuminance ⁽⁷⁾		0.50 min.

Notes ⁽⁵⁾ Uniformity ratio shall be calculated by the formula (2) and formula (3).

$$\text{Uniformity ratio of vertical illuminance } Uv = \frac{Ev_{\min}}{Ev_{\max}} \dots\dots\dots (2)$$

where, Uv : uniformity ratio of vertical illuminance

Ev_{\min} : minimum value of vertical illuminance (lx)

Ev_{\max} : maximum value of vertical illuminance (lx)

$$\text{Uniformity ratio of horizontal illuminance } Uh = \frac{Eh_{\min}}{Eh_{\max}} \dots\dots\dots (3)$$

where, Uh : uniformity ratio of horizontal illuminance

Eh_{\min} : minimum value of horizontal illuminance (lx)

Eh_{\max} : maximum value of horizontal illuminance (lx)

⁽⁶⁾ This means the vertical illuminance toward the side where camera is set, at a position 1.5 m high from the floor surface.

⁽⁷⁾ The horizontal illuminance on the floor surface.

Informative reference : Lighting of spectator stand: The vertical illuminance of the part adjacent to the field surface within the spectator stand facing to the side where camera is set should preferably be kept at the level approximately 0.25 times the value specified in Table 3.

5.2 Decreasing of flicker In the case of using discharge lamps, in order to decrease the flicker appearing on the television technical drawing, such countermeasures as to connect to three-phase power source and the like are to be taken.

5.3 Light source color and color rendering properties The light source color and color rendering properties shall have the values shown in Table 4.

Table 4 Light source color and color rendering properties

Light source color	Color temperature in the range of 6 000 K to 3 000 K
Color rendering properties	General color rendering index 55 min.

6 Maintenance and control For maintenance and control of lighting installation, the following works shall be carried out periodically.

- (1) Checking of burning condition
- (2) Exchange of lamps
- (3) Exchange of ballast (separate type only)
- (4) Cleaning
- (5) Checking of luminaires
- (6) Checking and repair of wiring and switching devices
- (7) Measurement (in accordance with Annex) and record of illuminance

Annex Measuring methods of illuminance

1 Scope This Annex specifies measuring methods of horizontal illuminance and vertical illuminance of sports halls.

The general rule of illuminance measurement other than those specified in this Annex shall be in accordance with **JIS C 7612**.

The illuminance meter to be used shall be that specified as general class AA in **JIS C 1609**, or that at least equivalent in performance.

2 Measuring methods of illuminance

2.1 Measuring range The measuring range of illuminance is the whole floor surface of sports hall.

2.2 Measuring points Divide the measuring range to areas of equal size as shown in Annex Fig. 1 and take the intersecting points of dividing lines as the measuring points. Make the measuring interval 3 m to 5 m.

2.3 Measurement of horizontal illuminance Measure the horizontal illuminance of measuring points shown in 2.2 at a height not more than 15 cm above the floor surface.

2.4 Average value of horizontal illuminance The average value of horizontal illuminance shall be calculated by formula (1).

$$Eh_{ave} = \frac{1}{4N} \left(\sum_{i=1}^4 E_{\square i} + 2 \sum_{i=1}^n E_{\triangle i} + 4 \sum_{i=1}^o E_{\circ i} \right) \dots\dots\dots (1)$$

where, Eh_{ave} : average value of horizontal illuminance

E_{\square} : illuminance at corner point

E_{\triangle} : illuminance at side point

E_{\circ} : illuminance at inner point

n : number of side points

o : number of inner points

N : number of blocks surrounded by dividing lines

2.5 Measurement of vertical illuminance In the sports field where television picture is taken, measure the vertical illuminance of 1.5 m above the floor surface on the measuring points shown in 2.2. The measuring directions of vertical illuminance are to be four directions as shown in Annex Fig. 2, and the object to be evaluated shall be the direction toward the main camera.

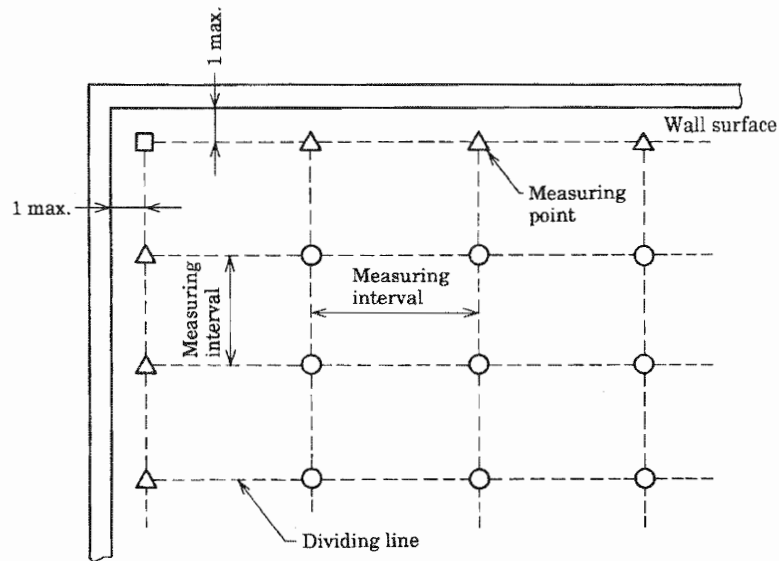
The average value of vertical illuminance shall be the value obtained by simply averaging the measured illuminances in every direction.

2.6 Omission of measuring points

- (1) In the case where both the lighting facilities and measuring range are symmetrical to the center line, measure relating to either one symmetrical surface and the other part may be omitted.

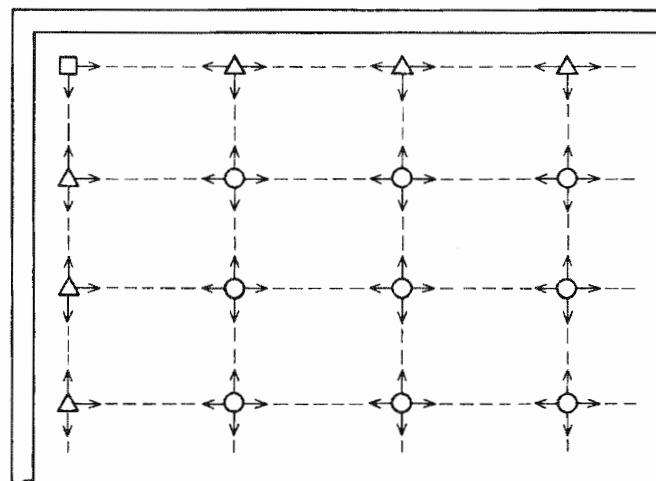
- (2) In the case of making the informative reference of maintenance and control, measure the illuminances at several representative points and the tendency of whole illuminance may be judged.

Unit : m



Remarks : The figure shows a part of measuring range of sports hall.

Annex Fig. 1 Illuminance measuring points



Remarks 1 Arrows indicate the direction of light receiving surface of illuminance meter.

2 The figure shows a part of measuring range of sports hall.

Annex Fig. 2 Measuring directions of vertical illuminance

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

Errata will be provided upon request, please contact:
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